

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

In the specification, the first paragraph has been amended on page 1.

Claims 14-25 were pending. By way of the present reply, Applicants have amended claims 14 and 15, and added new claims 26-44. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

Claims 14, 15, 24, and 25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over European Patent No. 0 480 750 to Mizuno et al. ("Mizuno"). Claims 17-23 were rejected under § 103(a) as being unpatentable over Mizuno in view of U.S. Patent No. 6,550,263 to Patel et al. ("Patel"). Applicants respectfully traverse these rejections for the reasons that follow.

Mizuno is drawn to a liquid cooling system for LSI packages. As shown in Fig. 5, IC packages 2 are disposed in a cooling chamber 10 that is tightly sealed to the printed circuit board to enclose the packages in the chamber. A heat sink 3 is mounted to each IC package 2 within the chamber. Nozzles 8 spray liquid, which evaporates and circulates through a condenser and heat exchanger. Evaporation of the liquid on the fins of the heat sink serve to cool the ICs. Since the chamber is tightly sealed, it is apparent that the cooling system is *not* designed to be detachable from the PCB, and that the cooling system is *not* used as part of a system that tests the IC package.

In contrast, the present invention as recited in independent claim 14 is drawn to a system for maintaining an IC-module under test near a set-point temperature. One feature of the invention is a container having an open end with a *seal for pressing against said IC-module while said IC-module is under test*. When testing is complete, the container is detached from the IC-module. Applicants have amended claim 14 to more clearly describe this aspect of the invention.

Another feature of the present invention is that testing is performed while the pressure within the container is sub-atmospheric. As explained in the specification, this provides leak tolerance during testing, since a leak will cause air to be sucked into the system, thereby avoiding the liquid coolant from spilling. This permits the use of conductive liquid coolant materials, such as water, in contrast to inert liquids, such as disclosed in Patel.

Dependent claims 15-26 incorporate the same combination of features as independent claim 14, and are patentable for the reasons noted above, as well as the additional features recited therein.

Applicants have further added new claims 27-44 to more particularly point out and describe Applicants' invention. Applicants submit that these claims are also patentable over the prior art of record.

Specifically, it is noted that although Mizuno's system may be used to cool each ICs during their operation, it fails to describe a system for maintaining the ICs at a set point as recited in claim 27. In particular, Mizuno discloses that the inside pressure of the cooling chamber is adaptively controlled so that it is maintained at an optimum condition for nucleate boiling. (See 4:49 et seq.) However, there is no disclosure or suggestion for maintaining the IC at a set point temperature. In particular, Mizuno's system is incapable of heating the IC elements, under conditions where the ICs would otherwise cool to a temperature below the set point.

In contrast, the present invention as recited in pending claim 27 maintains an IC-module near a set-point temperature while electrical power dissipation in the IC-module is varied. This is accomplished by use of both a cooling system, which utilizes one or more nozzles to spray liquid coolant on the IC-module under sub-atmospheric temperatures, in combination with one or more heating elements that add heat when the power dissipated by of the IC-module decreases such that the temperature of the IC-module would decrease below the set-point. As illustrated in the example discussed in Applicants' specification in reference to Fig. 3C, the present invention allows the temperature of the IC-module to be kept near constant even when the power dissipation drops to zero, and the IC-module would otherwise cool below set point due to conduction cooling of the IC substrate.

Like Mizuno, Patel fails to disclose a system that maintains temperature at a set point by controlling both a cooling system and a heating system. Instead, Patel discloses the use of only a cooling system. Consequently, Patel fails to disclose the features of claim 14 that are absent from Mizuno.

Dependent claims 28-44 incorporate the same combination of features as independent claim 27, and are patentable for the reasons noted above, as well as the additional features recited therein.

For at least these reasons, Applicants respectfully submit that all claims are patentable and that the present application is now in condition for allowance.

As a final matter, Applicants note that the specification is amended to more specifically identify related application No. 10/647,091, which shares the same specification as the present application. The related application issued on February 7, 2006 as U.S. Patent No. 6,995,980, and claims a system for maintaining an IC-module near a set-point temperature while electrical power dissipation is said IC-module is varied. As recited in claim 1 of the '980 patent, the system is comprised of: a container having an open end with a seal for pressing against said IC-module; at least one nozzle, in said container; at least one window, in said container; and, a closed-loop control means for--a) receiving a sensor signal representing a sensed temperature of said IC-module, b) cooling said IC-module, if said sensed temperature exceeds said set-point, by spraying a liquid coolant from said nozzle onto said IC-module, and c) heating said IC-module, if said set-point exceeds said sensed temperature, by sending electromagnetic radiation through said window onto said IC-module. Dependent claims 2-13 of the '980 patent recite additional features of the system of claim 1.


The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to

charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. § 1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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By 

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